

# PATENT ABSTRACTS OF JAPAN

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## (54) HEADPHONE DEVICE

(57)Abstract:

PROBLEM TO BE SOLVED: To reproduce a sound in an audible band and an inaudible band with fidelity.

SOLUTION: The device is provided with a couple of headphone units 6, 7 that produce sound. Each of the headphone units 6, 7 is provided with at least an audible band sound source 11 that generates a sound in an audible frequency band, an inaudible band sound source 12 for an inaudible band that produces sound in an inaudible frequency band, and a case 16 that contains the sound source 11 for an audible band and the sound source 12 for the inaudible band.

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## CLAIMS

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[Claim(s)]

[Claim 1] It is headphone equipment which is equipped with the headphone unit of the pair which generates sound, and is characterized by each above-mentioned headphone unit having with the case which contains the sound source for audible bands which generates the sound of the audible band of a frequency at least, the sound source for inaudibility bands which generates the sound of the inaudibility band of a frequency, and the above-mentioned sound source for audible bands and the above-mentioned sound source for inaudibility bands inside.

[Claim 2] The above-mentioned sound source for inaudibility bands is headphone equipment according to claim 1 characterized by equipping an abbreviation semi-sphere configuration with the piezoelectric device which has the piezo-electric diaphragm by which bulge formation was carried out.

[Claim 3] The above-mentioned piezoelectric device is headphone equipment according to claim 2 characterized by the bulge section by which bulge formation was carried out bulging toward the side in which an ear pinna is located when equipped with the above-mentioned headphone equipment.

[Claim 4] The above-mentioned piezoelectric device is headphone equipment according to claim 2 characterized by the bulge section by which bulge formation was carried out bulging toward the side and hard flow in which an ear pinna is located when equipped with the above-mentioned headphone equipment.

[Claim 5] The above-mentioned sound source for inaudibility bands is headphone equipment according to claim 1 characterized by generating the sound of a frequency higher than 20kHz.

[Claim 6] The above-mentioned sound source for inaudibility bands is headphone equipment according to claim 1 characterized by being arranged so that it may have directivity and may go to each ear pinna of right and left of an image location, respectively.

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## DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the headphone equipment which has the loudspeaker unit which changes an electrical signal into an acoustic signal.

[0002]

[Description of the Prior Art] A head and an ear pinna are equipped and the headphone equipment of the ear-pinna wearing mold which heard the playback sound emitted from a loudspeaker unit is known. This kind of headphone equipment is equipped with the head strap which supports the headphone unit and these headphone unit of the Uichi Hidari pair which generates sound to both ends, respectively.

[0003] As shown in drawing 7 , the headphone unit 51 with which conventional headphone equipment is equipped has the loudspeaker member 52 which generates sound, the support base 53 which supports this loudspeaker member 52, and the case 54 which contains the loudspeaker member 52 inside. The loudspeaker member 52 is arranged in the location which counters the external auditory meatus of an ear pinna. Moreover, the abbreviation annular cushion member 55 is attached in the support base 53, and the headphone unit 51 is intercepting the outside sound while protecting the ear pinna which contacts the support base 53 by the cushion member 55.

[0004] The headphone unit 51 constituted as mentioned above generates the sound of the audible band of a frequency from the loudspeaker member 52 by inputting an acoustic signal from a record regenerative apparatus etc.

[0005]

[Problem(s) to be Solved by the Invention] By the way, the record regenerative apparatus which outputs an acoustic signal is made possible [ carrying out record playback of the audible band and inaudibility band of a frequency, respectively ] in recent years.

[0006] However, conventional headphone equipment had the trouble that the acoustic signal of the frequency higher than 20kHz which is the upper limit of an audible band was unreproducible. That is, conventional headphone equipment had the problem that playback \*\*\*\*\* could not do all the acoustic signal components reproduced with a record regenerative apparatus.

[0007] Then, this invention aims at offering the headphone equipment which can reproduce faithfully the sound of the audible band of a frequency, and an inaudibility band.

[0008]

[Means for Solving the Problem] In order to attain the purpose mentioned above, the headphone equipment concerning this invention is equipped with the sound source for inaudibility bands which is contained inside a case and generates the sound of the inaudibility band of a frequency.

[0009] As for the headphone equipment constituted as mentioned above, the sound of

an inaudibility band is generated from the sound source for audible bands.

[0010] Moreover, the headphone equipment concerning this invention is equipped with the piezoelectric device in which the sound source for inaudibility bands has the piezo-electric diaphragm formed in the shape of an abbreviation semi-sphere.

[0011] The headphone equipment constituted as mentioned above generates the acoustic signal of the inaudibility band of a frequency good, when the sound source for inaudibility bands generates indirectly \*\*\*\*\* which vibrates a case, while generating sound directly from a piezo-electric diaphragm.

[0012]

[Embodiment of the Invention] Hereafter, headphone equipment is explained with reference to a drawing about the concrete operation gestalt of this invention.

Headphone equipment 1 is equipped with the head strap 8 which supports the headphone units 6 and 7 and these headphone units 6 and 7 of the Uichi Hidari pair which generates sound to both ends, respectively as shown in drawing 1 .

[0013] Each headphone units 6 and 7 are equipped with the sound-source section 11 for audible bands in which a frequency generates the acoustic signal of an audible band 20kHz or less, and the sound-source section 12 for inaudibility bands which generates the acoustic signal of the inaudibility band where a frequency is bigger than 20kHz as shown in drawing 2 .

[0014] Moreover, each headphone units 6 and 7 are equipped with the cushion member 15 prepared by being located between the support base 14 which supports the sound-source section 11 for audible bands, and the sound-source section 12 for inaudibility bands, and this support base 14 and ear pinna 5, and the case 16 which contains each sound sources 11 and 12 and the support base 14 inside.

[0015] The sound source 11 for audible bands is the so-called loudspeaker member of a conductivity type, and is established on the support base 14. The sound source 11 for audible bands has the frame 23 which supports the diaphragm 21 which generates sound, the magnetic circuit 22 which vibrates this diaphragm 21, and these diaphragms 21 and a magnetic circuit 22. The diaphragm 21 is formed for example, in the dome mold, and is arranged in the location which counters the external auditory meatus of an ear pinna 5. Although a magnetic circuit 22 is not illustrated, it has the voice coil bobbin prepared in the center section of a diaphragm 21, the voice coil wound around this voice coil bobbin, York, a magnet which constitute a magnetic path, etc.

[0016] As shown in drawing 2 , when a user's head is equipped with headphone equipment 1, the sound source 12 for inaudibility bands is arranged on the support base 14 so that it may be located in the transverse-plane side of a user's ear pinna 5. This sound source 12 for inaudibility bands has the piezoelectric device 26 which generates the acoustic signal of the inaudibility band where a frequency is higher than 20kHz.

[0017] The piezoelectric device 26 has the wiring 29 which supplies a current at the

piezo-electric diaphragm 27 by which bulge formation was carried out, the disc-like substrate 28 which supports this piezo-electric diaphragm 27, and the piezo-electric diaphragm 27 in the abbreviation semi-sphere configuration, as shown in drawing 3 . The piezo-electric diaphragm 27 has the electrode plates 31 and 31 of the pair which curves by impressing an electrical potential difference, and the ceramics 32 arranged among these electrode plates 31 and 31, as shown in drawing 3 . This piezo-electric diaphragm 27 is made into indirectivity by being formed in the shape of an abbreviation semi-sphere. The substrate 28 is formed in disc-like of the aluminum. On the substrate 28, junction immobilization of the piezo-electric diaphragm 27 is carried out by adhesives etc. Wiring 29 is joined to each electrode plates 31 and 31, respectively.

[0018] And the piezoelectric device 26 of the sound source 12 for inaudibility bands is arranged by the sense which bulges the bulge section of the piezo-electric diaphragm 27 in an ear-pinna 5 side as shown in drawing 2 . As for this piezoelectric device 26, screw stop immobilization of the substrate 28 is carried out for example, on the support base 14.

[0019] When the piezo-electric diaphragm 27 vibrates, while the piezoelectric device 26 constituted as mentioned above generates the sound of an inaudibility band directly from the piezo-electric diaphragm 27, the piezo-electric diaphragm 27 vibrates a case 16, and generates the sound of an inaudibility band from case 16 the very thing. For this reason, a piezoelectric device 26 can generate the sound of an inaudibility band good.

[0020] About the piezoelectric device 26 mentioned above, frequency characteristics are explained with reference to drawing 4 . In addition, an axis of abscissa shows a frequency in drawing 4 , and an axis of ordinate shows sound pressure level. As shown in drawing 4 , a piezoelectric device 26 can reproduce the frequency band higher than 20kHz made into the inaudibility band of a frequency good.

[0021] In addition, the piezoelectric device 26 mentioned above may be made into the configuration constituted combining the part and two or more curved surfaces of the spherical surface although the piezo-electric diaphragm 27 was formed in the shape of an abbreviation semi-sphere. By the way, although the piezoelectric device 26 mentioned above was located and arranged in a user's principal plane side, other headphone units 36 as shown, for example in drawing 5 may be used.

[0022] Moreover, although the piezoelectric device 26 mentioned above was arranged by the sense which bulges the bulge section of the piezo-electric diaphragm 27 by which bulge formation was carried out in an ear-pinna 5 side, the headphone unit 46 of further others as shown, for example in drawing 6 may be used. These headphone units 36 and 46 are explained with reference to a drawing. In addition, the same sign is given to the same member as the headphone units 6 and 7 mentioned above in drawing 5 and drawing 6 , and explanation is omitted to it.

[0023] the time of a user being equipped with a piezoelectric device 26, as for the

headphone unit 36 as shown in drawing 5 -- the side-face side of a user's head --  
\*\*\*\*\* -- it is arranged like. Moreover, as shown in drawing 6 , the headphone unit 46  
is arranged by the sense in which the bulge section of the piezo-electric diaphragm  
27 with which a piezoelectric device 26 is equipped bulges hard flow a case 16, i.e.,  
external auditory meatus of ear pinna 5, side.

[0024] Moreover, using the flat-surface diaphragm which has directivity, although not  
illustrated, a piezoelectric device may be set up so that the image location of the  
sound to generate may be located in the location near the external auditory meatus  
of each ears pinna 5 and 5 on either side, respectively.

[0025] As the support base 14 with which headphone equipment 1 is equipped is  
shown in drawing 2 , it is formed in the abbreviation cross-section U shape, and the  
space where an ear pinna 5 is contained is prepared. As shown in the support base 14  
at drawing 2 , the guard plate 17 which protects the sound source 11 for audible  
bands and the sound source 12 for inaudibility bands is arranged in the location which  
counters the sound source 11 for audible bands, and the sound source 12 for  
inaudibility bands. As a guard plate 17 is shown in drawing 2 , it is formed in the shape  
of cross-section abbreviation for L characters with the metallic material, and two or  
more bore 17a is drilled in each field which counters the sound source 11 for audible  
bands, and the sound source 12 for inaudibility bands, respectively.

[0026] As shown in drawing 2 , the cushion member 18 with which headphone  
equipment 1 is equipped is attached in the support base 14, and is formed in  
abbreviation annular by covering shock absorbing material 18a, such as sponge, by  
leather material 18b etc. The cushion member 18 is intercepting the outside sound  
which advances into the interior while protecting the ear pinna 5 which contacts the  
support base 14.

[0027] Moreover, as shown in drawing 1 , the head strap 8 with which headphone  
equipment 1 is equipped is formed with the ingredient which has elasticity, and is  
supporting the headphone units 6 and 7 through the support arm 34 prepared in both  
ends, respectively. The support arm 34 is supported by the both ends of a head strap  
8 free [ migration ] along with the longitudinal direction of a head strap 8, and is made  
possible [ adjusting the location to the ear pinna 5 of each headphone units 6 and 7 ].  
The rotation attachment component 34 supported for each headphone units 6 and 7,  
enabling free rotation is formed in the point of the support arm 33, and it is supposed  
that it is possible to adjust the sense of each headphone units [ as opposed to an ear  
pinna 5 for this rotation attachment component 34 ] 6 and 7 therefore.

[0028] Moreover, each headphone units 6 and 7 supported by the both ends of a head  
strap 8, respectively are arranged by the sense which makes the sound source 11 for  
audible bands counter the external auditory meatus of an ear pinna 5, and are  
energized by drawing 1 Nakaya mark a1 direction and arrow-head a 2-way which  
approach mutually according to the elastic force of a head strap 8 and which are a  
direction.

[0029] Moreover, as headphone equipment 1 is shown in drawing 1 , it has the connecting cord 35 to which the sound source 11 for audible bands and the sound source 12 for inaudibility bands, and the end section of the headphone units 6 and 7 were connected, and the other end is connected to the signal output part of the record regenerative apparatus which this connecting cord 35 does not illustrate.

[0030] The sound of an inaudibility band generates the headphone equipment 1 constituted as mentioned above from the sound source 12 for inaudibility bands, and a case 16 while it generates the sound of an audible band from the sound source 11 for audible bands of each headphone units 6 and 7 by inputting the acoustic signal of an audible band and an inaudibility band from a record regenerative apparatus etc., respectively. Therefore, headphone equipment 1 generates the sound of the audible band of a frequency, and an inaudibility band good, respectively.

[0031] As mentioned above, headphone equipment 1 can generate faithfully the acoustic signal of the inaudibility band reproduced with a record regenerative apparatus by having formed the sound source 11 for inaudibility bands in each headphone units 6 and 7.

[0032] Moreover, the sound and the piezo-electric diaphragm 27 which are directly generated from the piezo-electric diaphragm 27 can vibrate a case 16, and the sound source 12 for audible bands with which headphone equipment 1 is equipped can generate the sound of a frequency higher than 20kHz good with the sound generated indirectly from a case 16.

[0033]

[Effect of the Invention] According to the headphone equipment applied to this invention as mentioned above, the acoustic signal of the inaudibility band reproduced with a record regenerative apparatus can be faithfully generated by having a sound source for inaudibility bands.

[0034] Moreover, the headphone equipment concerning this invention can generate the sound of the inaudibility band of a frequency good with the sound which the sound and the piezo-electric diaphragm generated from a piezo-electric diaphragm vibrate a case, and generate.

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## DESCRIPTION OF DRAWINGS

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[Brief Description of the Drawings]

[Drawing 1] It is the front view showing the headphone equipment concerning this invention.

[Drawing 2] It is a headphone unit \*\*\*\* cross-sectional view equipped with the above-mentioned headphone equipment.

[Drawing 3] It is drawing of longitudinal section showing the piezoelectric device with which the above-mentioned headphone unit is equipped.

[Drawing 4] It is drawing showing the frequency characteristics of the above-mentioned piezoelectric device.

[Drawing 5] It is the mimetic diagram showing other headphone equipments concerning this invention.

[Drawing 6] It is the mimetic diagram showing the headphone equipment of further others concerning this invention.

[Drawing 7] It is the mimetic diagram showing conventional headphone equipment.

[Description of Notations]

1 6 Headphone Equipment, 7 Headphone Unit, 11 Sound Source for Audible Bands, 12 Sound Source for Inaudibility Bands, 16 Case, 26 Piezoelectric Device, 27 Piezo-electric Diaphragm

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